SHARP

No.	**LD-K22152**
DATE	Feb. 1, 2010

TENTATIVE

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LK816D3LA19

The technical literature is subject to change without notice. So, please contact SHARP or its representative before designing your product based on this literature.

MODULE DEVELOPMENT CENTER
AVC LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

RECORDS OF REVISION

LK816D3LA19

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-K22152	Feb. 1, 2010	-	-	-	1st. Issue

1. Application

This technical literature applies to the color 81.6" TFT-LCD module LK816D3LA19.

* In case of using the device for applications such as control and safety equipment for transportation (aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

* Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

* SHARP assumes no responsibility for any damage resulting from the use of the device that does not comply with the instructions and the precautions specified in these technical literature sheets.

* Contact and consult with a SHARP sales representative for any questions about this device.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, inverter circuit and back light system etc. Graphics and texts can be displayed on a 1080×RGB×1920 dots panel with one billion colors by using LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

This module also includes the DC/AC inverter to drive the CCFT. (+24V of DC supply voltage)

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the liquid crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

By using the captioned process, the image signals of this LCD module are being set so that image response can be completed within one frame, as a result, image blur can be improved and clear image performance can be realized.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size（Diagonal）	2071.83	mm
	81.5683	inch
Active area	1015.74 (H) x 1805.76 (V)	mm
Pixel Format	1080 (H) x 1920 (V) （1pixel = R + G + B dot）	pixel
Pixel pitch	0.9405(H) x 0.9405 (V)	mm
Pixel configuration	R, G, B horizontal stripe	
Display mode	Normally black	
Unit Outline Dimensions (*1)	1094 (W) x 1879 (H) x 81.9 (D)	mm
Mass	64.8±1.0	kg
Surface treatment	Anti glare, low reflection coating Hard coating: 2H	

(*1) Outline dimensions are shown in Fig.1.

4. Input Terminals

4-1. TFT panel driving

CN1 (Interface signals) on CPWB

Using connector : FI-RE51S-VF (Japan Aviation Electronics Industry, Ltd.)

Mating connector : FI-RE51HL (Japan Aviation Electronics Industry, Ltd.)

Mating LVDS transmitter : THC63LVD1023B (THine) or equivalent device

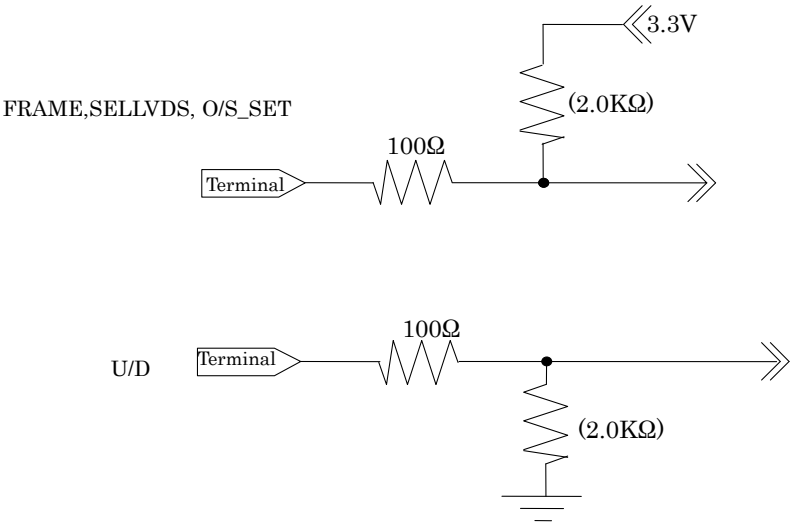
Pin No.	Symbol	Function	Remark
1	FRAME	Frame frequency setting H:60Hz, L:50Hz	Pull up 3.3V(by 2.0kΩ) [Note 1]
2	Reserved	It is required to set non-connection (OPEN).	
3	Reserved	It is required to set non-connection (OPEN).	
4	Reserved	It is required to set non-connection (OPEN).	
5	TEMP_Error	Error output at the ultra high temperature [Note 5] H: Protection function operates L: Normal operation	
6	U/D	Vertical shift direction [Note 3]	Pull down GND(by2.0kΩ) [Note 1]
7	SELLVDS	Select LVDS data order [Note 2]	Pull up 3.3V(by 2.0kΩ) [Note 1]
8	O/S_SET	O/S operation setting H: O/S driving ON, L: O/S driving OFF	Pull up 3.3V(by 2.0kΩ) [Note 1]
9	INV_duty	Inverter Brightness Control [Note 4]	
10	INV_ON/OFF	Inverter ON/OFF setting H:ON, L:OFF	
11	GND		
12	AIN0-	A port (-)LVDS CH0 differential data input	
13	AIN0+	A port (+)LVDS CH0 differential data input	
14	AIN1-	A port (-)LVDS CH1 differential data input	
15	AIN1+	A port (+)LVDS CH1 differential data input	
16	AIN2-	A port (-)LVDS CH2 differential data input	
17	AIN2+	A port (+)LVDS CH2 differential data input	
18	GND		
19	ACK-	A port LVDS Clock signal(-)	
20	ACK+	A port LVDS Clock signal(+)	
21	GND		
22	AIN3-	A port (-)LVDS CH3 differential data input	
23	AIN3+	A port (+)LVDS CH3 differential data input	
24	AIN4-	A port (-)LVDS CH4 differential data input	
25	AIN4+	A port (+)LVDS CH4 differential data input	
26	GND		
27	GND		
28	BIN0-	B port (-)LVDS CH0 differential data input	
29	BIN0+	B port (+)LVDS CH0 differential data input	
30	BIN1-	B port (-)LVDS CH1 differential data input	
31	BIN1+	B port (+)LVDS CH1 differential data input	
32	BIN2-	B port (-)LVDS CH2 differential data input	
33	BIN2+	B port (+)LVDS CH2 differential data input	
34	GND		
35	BCK-	B port LVDS Clock signal(-)	
36	BCK+	B port LVDS Clock signal(+)	
37	GND		
38	BIN3-	B port (-)LVDS CH3 differential data input	
39	BIN3+	B port (+)LVDS CH3 differential data input	
40	BIN4-	B port (-)LVDS CH4 differential data input	

41	BIN4+	B port (+)LVDS CH4 differential data input	
42	GND		
43	GND		
44	GND		
45	GND		
46	GND		
47	NC	It is required to set non-connection (OPEN).	
48	NC	It is required to set non-connection (OPEN).	
49	NC	It is required to set non-connection (OPEN).	
50	NC	It is required to set non-connection (OPEN).	
51	NC	It is required to set non-connection (OPEN).	

* L: Low level voltage (GND). H: High level voltage (3.3V)

*Connect the GND of the liquid crystal panel drive part to the chassis of the module.

[Note1] The equivalent circuit figure of the terminal



[Note2] LVDS data order (SELLVDS=H:JEIDA Mode, L:VESA Mode)

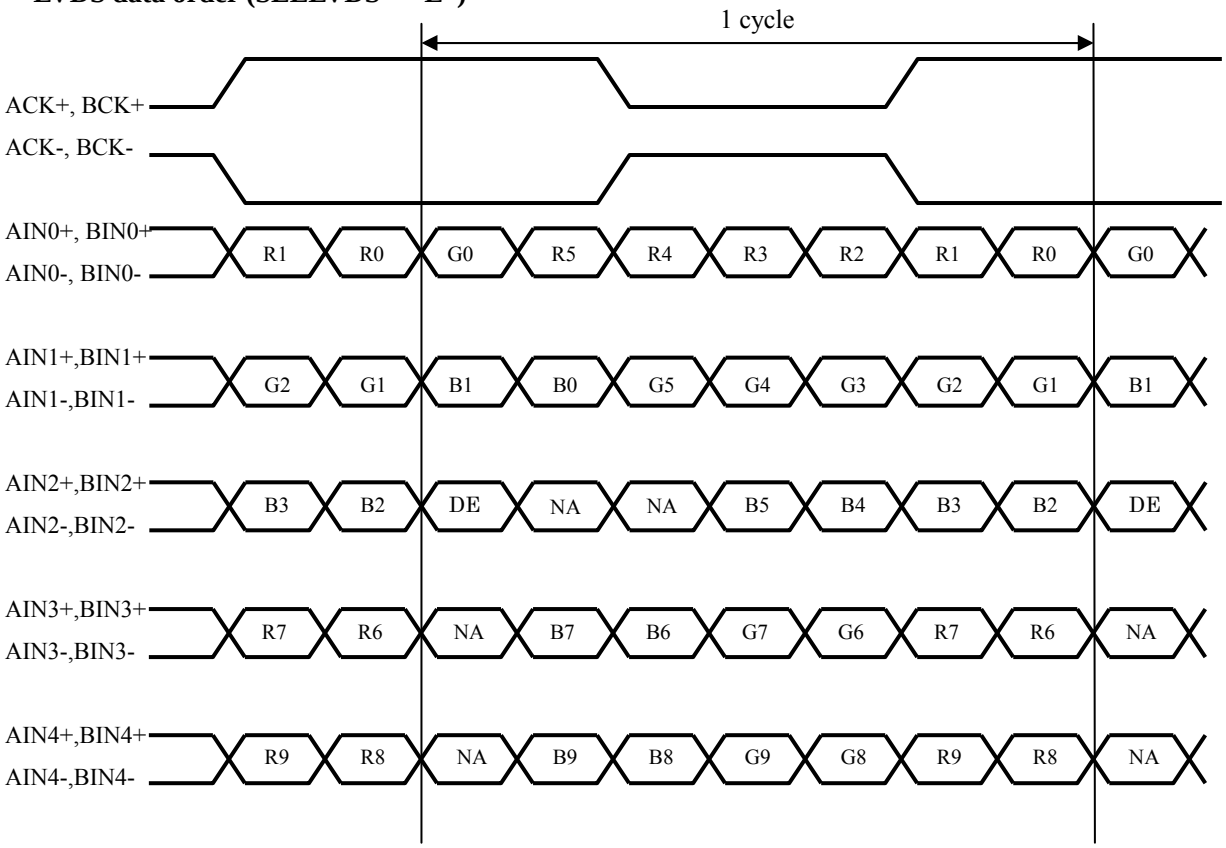
Transmitter Data	SELLVDS = "L"(GND) LVDS data	SELLVDS = "H"(3.3V) or Open LVDS data
TA0	R0(LSB)	R4
TA1	R1	R5
TA2	R2	R6
TA3	R3	R7
TA4	R4	R8
TA5	R5	R9(MSB)
TA6	G0(LSB)	G4
TB0	G1	G5
TB1	G2	G6
TB2	G3	G7
TB3	G4	G8
TB4	G5	G9(MSB)
TB5	B0(LSB)	B4
TB6	B1	B5
TC0	B2	B6
TC1	B3	B7
TC2	B4	B8
TC3	B5	B9(MSB)
TC4	HSYNC	HSYNC
TC5	VSYNC	VSYNC
TC6	DE	DE
TD0	R6	R2
TD1	R7	R3
TD2	G6	G2
TD3	G7	G3
TD4	B6	B2
TD5	B7	B3
TD6	N/A	N/A
TE0	R8	R0(LSB)
TE1	R9(MSB)	R1
TE2	G8	G0(LSB)
TE3	G9(MSB)	G1
TE4	B8	B0(LSB)
TE5	B9(MSB)	B1
TE6	N/A	N/A

NA: Not Available

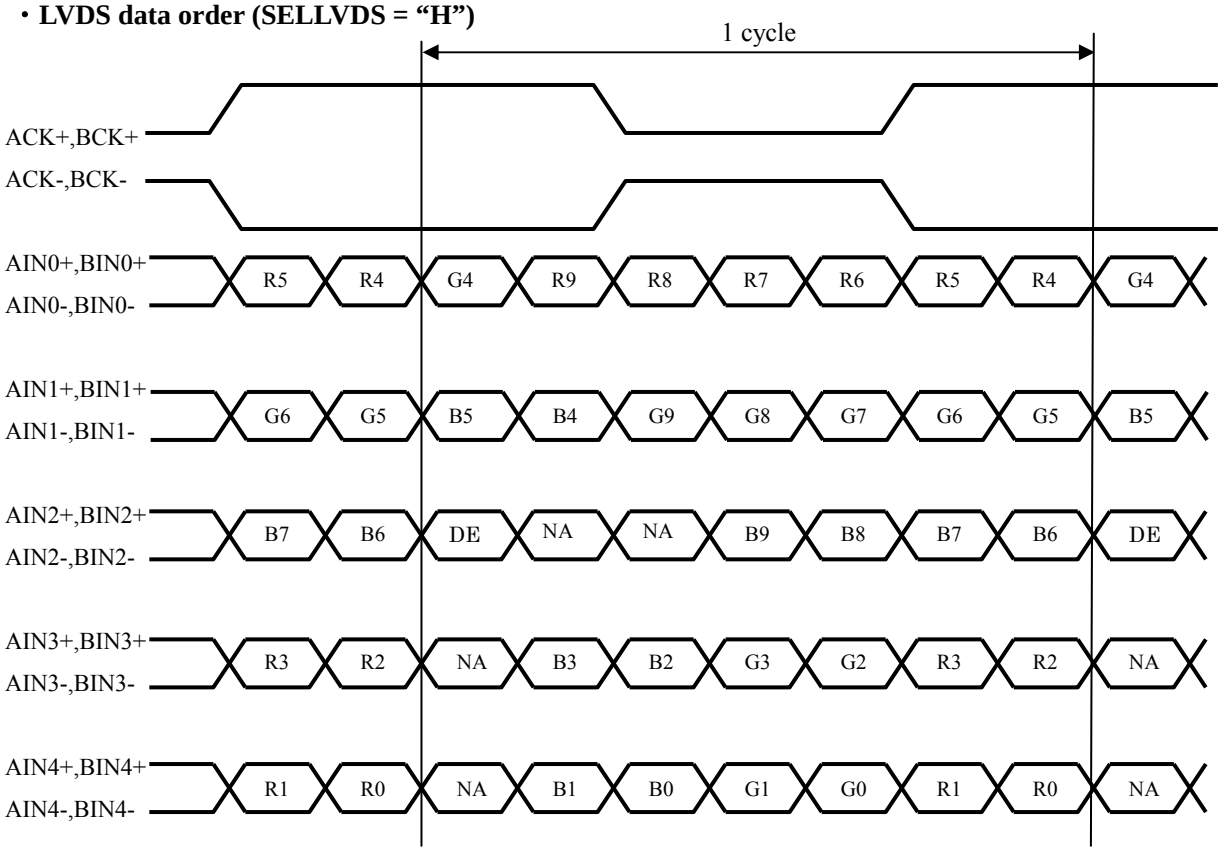
*Since the display position is prescribed by the rise of DE (Display Enable) signal, please do not fix DE signal during operation at "High".

*HSYNC and VSYNC are not necessary

・**LVDS data order (SELLVDS = “L”)**



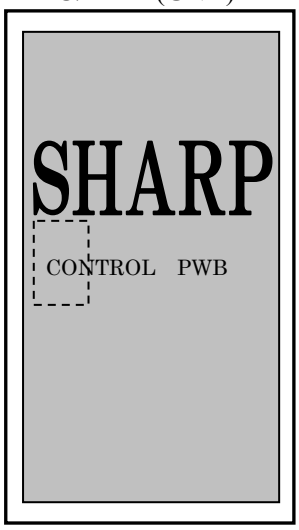
・**LVDS data order (SELLVDS = “H”)**



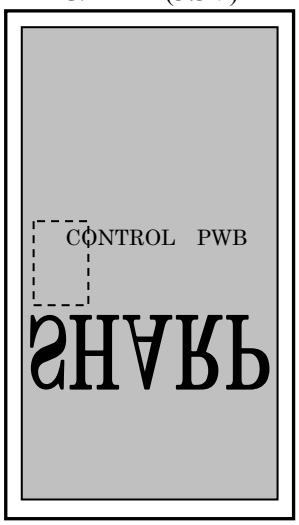
DE: Display Enable, NA: Not Available (Fixed Low)

[Note 3]Display reversal function

Normal (Default)
U/D : L (GND)

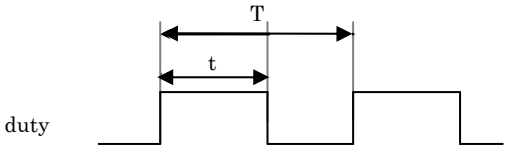


Vertical reverse image
U/D : H (3.3V)



[Note 4]Brightness Control (Pulse PWM dimming)

Pin No. 9 is used for the control of the PWM duty with input pulse.



Ta = 25°C

		MIN	TYP	MAX	Remark
Pulse signal	[Hz]	155	165	175	
DUTY (t/T)	[%]	20	-	100	

*There is a case that lamp mura may happen, depending on ambient temperature, in dimming. Minimum dimming level should be set according to your evaluation of actual display performance. (Minimum duty 60% at below 15℃)

[Note 5] Error output at the ultra high temperature

For the protection of the module C_PWB decreases DUTY of PWM of the inverter to 30% forcibly when the temperature of the module is more than (85) ℃. Duty of PWM of the inverter returns to a normal state afterwards when the temperature of the module is less than (55) ℃.

Error output is Low (0V) at normal state. Error output becomes High (3.3V) when protection function operates.

CN2 (+12V DC power supply)　on CONTROL PWB

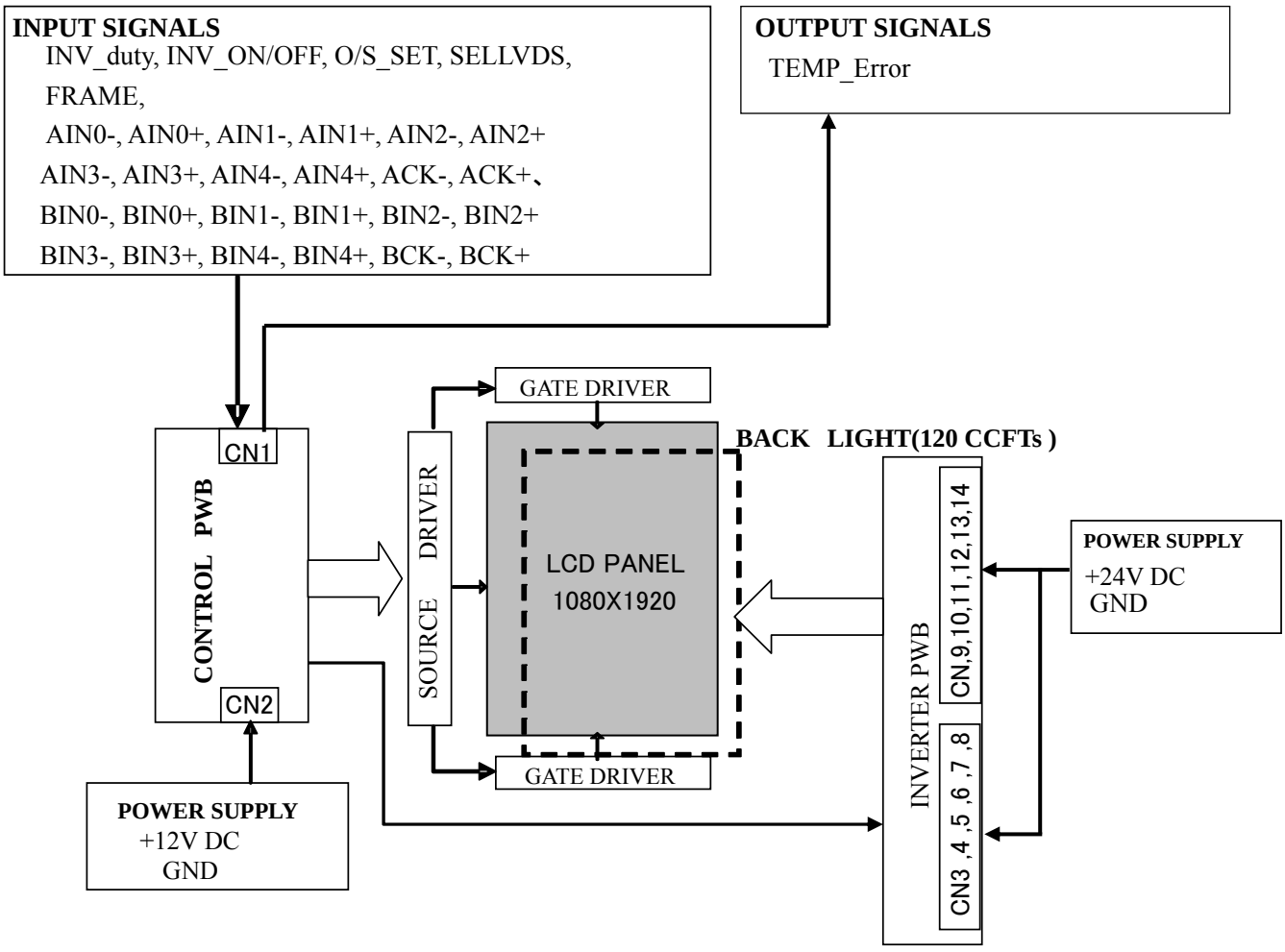
Using connector　: SM04B-PASS-TBT　(J.S.T. Mfg Co., Ltd.)

Mating connector　: PAP-04V-S　(J.S.T. Mfg Co., Ltd.)

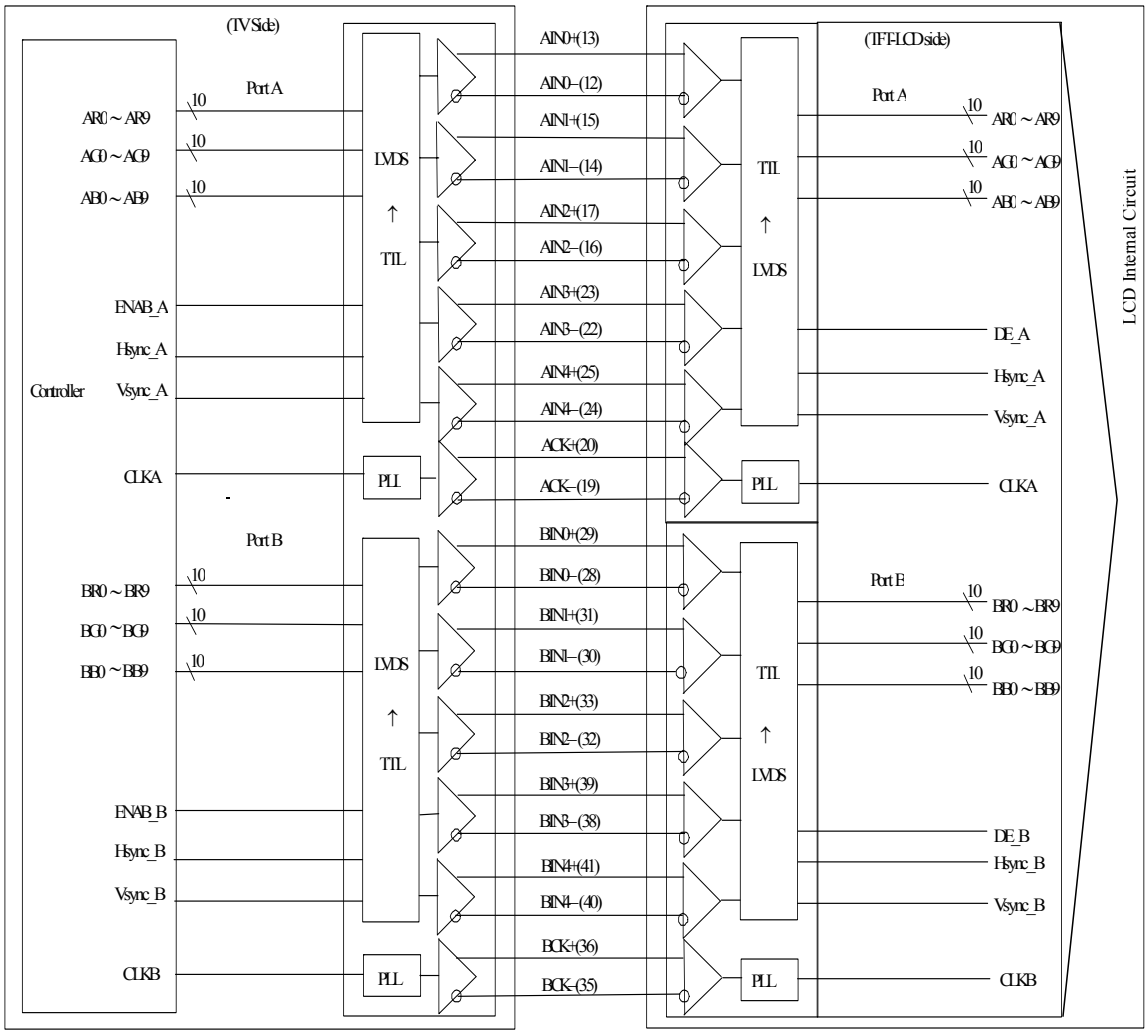
Pin No.	Symbol	Function	Remark
1	VCC	+12V　Power Supply	
2	VCC	+12V　Power Supply	
3	GND	GND	
4	GND	GND	

*Current rating : 3A (AWG#22)

Block Diagram (LCD Module)



Interface block diagram



Corresponding Transmitter: THC63LVD1023B (THine) or equivalent device

4-2. Backlight driving

Inverter connecter1 (+24V DC power supply and inverter control)

CN3, CN4, CN5, CN6, CN7, CN8 (Inverter Power input Pin layout) on INVERTER PWB

Using connector: S14B-PH-K-S (LF) (J.S.T. Mfg Co.,Ltd.)

Mating connector: PHR-14 (J.S.T. Mfg Co.,Ltd.)

Pin No.	Symbol	Function	Remark
1	V_{INV}	+24V	
2	V_{INV}	+24V	
3	V_{INV}	+24V	
4	V_{INV}	+24V	
5	V_{INV}	+24V	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	GND	GND	
10	GND	GND	
11	Reserved	It is required to set non-connection (OPEN).	
12	Reserved	It is required to set non-connection (OPEN).	
13	Reserved	It is required to set non-connection (OPEN).	
14	Reserved	It is required to set non-connection (OPEN).	

*Current rating : 2A (AWG#24)

Inverter connecter2 (+24V DC power supply)

CN9, CN10, CN11, CN12, CN13, CN14 (Inverter Power input Pin layout) on INVERTER PWB

Using connector : S12B-PH-K-S(LF) (J.S.T. Mfg Co.,Ltd.)

Mating connector : PHR-12 (J.S.T. Mfg Co.,Ltd.)

Pin No.	Symbol	Function	
1	V_{INV}	+24V	
2	V_{INV}	+24V	
3	V_{INV}	+24V	
4	V_{INV}	+24V	
5	V_{INV}	+24V	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	GND	GND	
10	GND	GND	
11	Reserved	It is required to set non-connection (OPEN)	
12	Reserved	It is required to set non-connection (OPEN)	

*Current rating : 2A (AWG#24)

4-3. the back light system characteristics

The back light system is direct type with 120 CCFTs (Cold Cathode Fluorescent Tube).

The characteristics of the lamp are shown in the following table.

The value mentioned below is at the case of one CCFT.

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Life time	T_L	-	(60000)	-	Hour	

[Note] ・Lamp life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the condition the Ta=25 ℃ and brightness control(duty=100%).

・Above value is applicable when the long side of LCD module is placed vertically (Portrait position).

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage (for Control)	V_I	Ta=25 ℃	-0.3 ~ 3.6	V	[Note 1]
12V supply voltage (for Control)	VCC	Ta=25 ℃	0 ~ + 14	V	
24V supply voltage (for Inverter)	V_{INV}	Ta=25 ℃	0 ~ +27	V	
Storage temperature	Tstg	-	-25~ +60	℃	[Note 2]
Operation temperature (Ambient)	Topa	-	0 ~ +35	℃	[Note 3] [Note 4] [Note 5]

[Note 1] FRAME, SELLVDS, O/S_SET, U/D,INV_duty,INV_ON/OFF

[Note 2] Humidity 95%RH Max.(Ta≦40℃)

Maximum wet-bulb temperature at 39 ℃ or less.(Ta>40 ℃) / No condensation.

[Note 3] Temperature Uniformity :10 ℃ Max.

[Note 4] Glass surface temperature : 55 ℃ Max,

[Note 5] To put out high brightness a lot of lamps are built into this module. Therefore, when this module is operated, cooling this module is required. There is a possibility of damaging the module when a surrounding operating temperature is exceeded.

6. Electrical Characteristics

6-1. Control circuit driving

Ta=25 ℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+12V supply voltage	Supply voltage	Vcc	11.4	12.0	12.6	V	[Note1]
	Current dissipation	Icc	-	(0.9)	(1.5)	A	[Note2]
	Inrush current	$I_{RUSH}1$	-	(TBD)	-	A	t1=500us
		$I_{RUSH}2$	-	(TBD)	-	A	t1>5ms
Permissible input ripple voltage		V_{RP}	-	-	100	mV_{P-P}	Vcc = +12.0V
Input Low voltage		V_{IL}	0	-	0.8	V	[Note4]
Input High voltage		V_{IH}	2.3	-	3.6	V	
Input leak current (Low)		I_{IL}	-	-	400	μA	V_I = 0V
Input leak current (High)		I_{IH}			100	μA	V_I=3.3V
Terminal resistor		R_T	-	100	-	Ω	Differential input
Input Differential Voltage		|VID|	200	400	600	mV	[Note3]
Differential Input common mode voltage		VCM	|VID|/2	1.2	2.4-|VID|/2	V	[Note3]

[Note]V_{CM}: Common mode voltage of LVDS driver.

[Note 1]

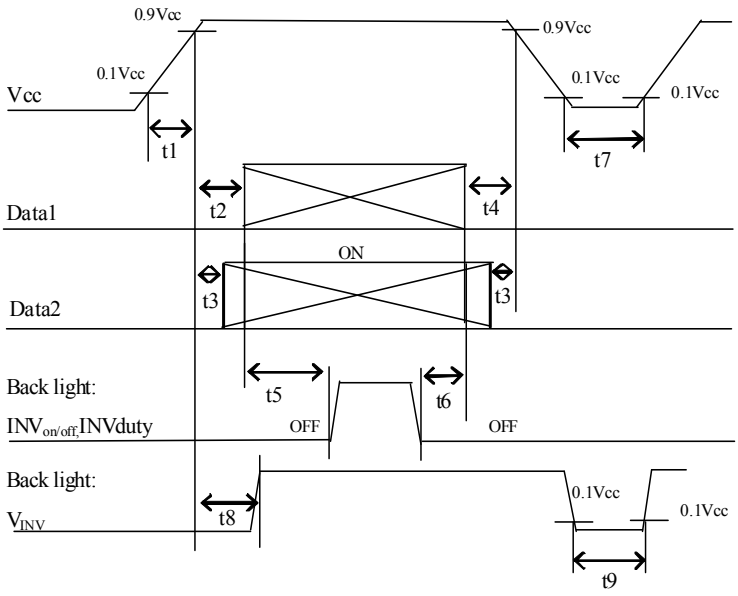
Input voltage sequences

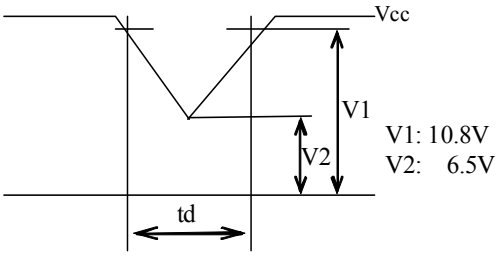
0.1 ms < t1 ≦ 20 ms
10 ms < t2 ≦ 50 ms
10 ms < t3 ≦ 50 ms
0 ms < t4 ≦ 1 s
t5 ≧ 1 s
t6 ≧ 0
t7 ≧ 1 s
t8 ≧ 500 ms
t9 ≧ 1 s

Dip conditions for supply voltage

a) 6.5V ≦ Vcc < 10.8V
td ≦ 10 ms
b) Vcc < 6.5 V

Dip conditions for supply voltage is based on input voltage sequence.

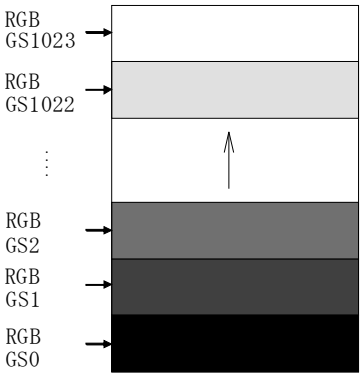




Data1:ACK±,AIN0±,AIN1±, AIN2±, AIN3±, AIN4±, BCK±,BIN0±,BIN1±, BIN2±, BIN3±, BIN4±
Data2:SELLVDS, FRAME, O/S_SET,

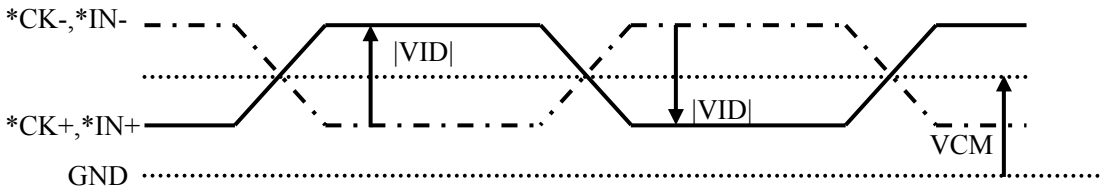
＊About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

[Note 2] Typical current situation: 1024 gray-bar patterns. (Vcc = +12.0V)
The explanation of RGB gray scale is seen in section 8.



Vcc＝12.0V
CK＝74.25MHz
TT＝14.8μs

[Note3] ACK±,BCK±,AIN0±,AIN1±,AIN2±,AIN3±, AIN4±,BIN0±,BIN1±,BIN2±,BIN3±, BIN4±



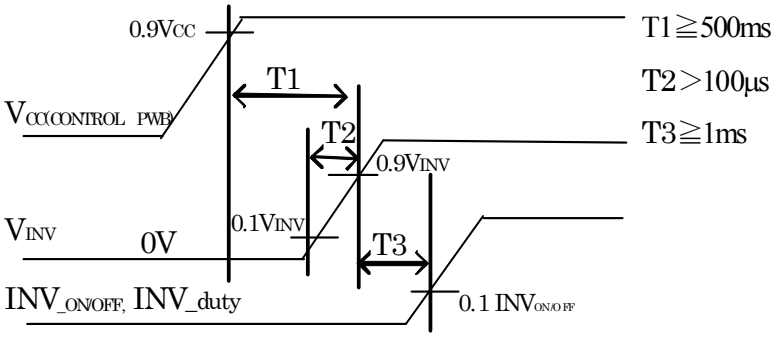
[Note4] SELLVDS, FRAME, O/S_SET, U/D, INV_duty,INV_ON/OFF

6-2. Inverter driving for back light

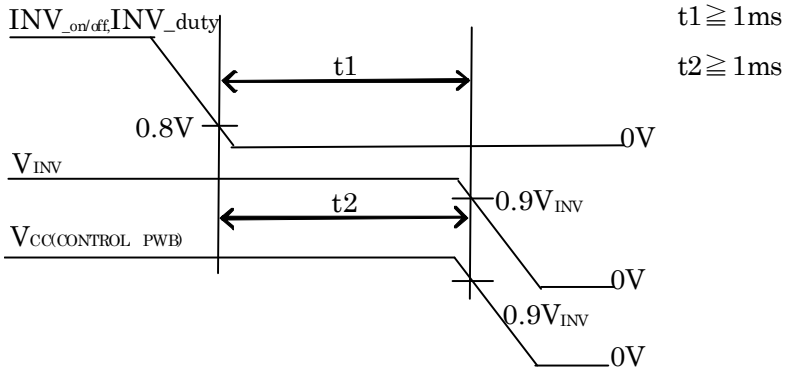
The back light system is direct type with 120CCFTs (Cold Cathode Fluorescent Tube). Ta=25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
＋24V	Supply voltage	V_{INV}	23.0	24.0	25.0	V	INV_ON/OFF=3.3V INV_duty = 100% 【Note1】【Note2】
	Current dissipation1	I_{INV1}	-	(62)	(70)	A	V_{INV} = 24V INV_ON/OFF=3.3V INV_duty = 100% 【Note1】【Note2】
			-	(TBD)	(TBD)	A	V_{INV} = 24V INV_ON/OFF=3.3V INV_duty = 100% ※with cooling module 【Note1】【Note2】
	Current dissipation2	I_{INV2}	-	(50)	(58)	A	V_{INV} = 24V INV_ON/OFF=3.3V INV_duty = 100% 【Note1】【Note2】
			-	(65)	(75)	A	V_{INV} = 24V INV_ON/OFF=3.3V INV_duty = 100% ※with cooling module 【Note1】【Note2】
Permissible input ripple voltage		V_{RF}	-	-	300	mV_{p-p}	V_{INV} = 24V
Input voltage (Low)		V_{ONL}	0	-	0.8	V	INV_ON/OFF, INV_duty 【Note1】
Input voltage (High)		V_{ONH}	2.3	3.3	3.6	V	

【Note 1】 1)V_{INV}-turn-on condition



2) V_{INV}-turn-off condition



【Note 2】 Current dissipation1 : Definition within 120 minutes after turn on.(Rush current Is excluded)
Current dissipation2 : Definition more than 120 minutes after turn on.

【Note】 The inverter unit is driving at the following drive frequency.

*The lamp drive frequency : 31.4 ±2.0 kHz

*The burst Brightness control drive frequency : 165 ± 10 Hz

7. Timing characteristics of input signals

7-1. Timing characteristics

This LCD module is designed to be used in portrait position other than input signal.

The definition of input signal is based on landscape position. Therefore, please ensure to take it into account in designing your set.

Timing diagrams of input signal are shown in Fig.2.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	69	74.25	76	MHz	
Data enable signal	Horizontal period	TH	1084	1100	1200	clock	
			14.6	14.8	16.1	μs	
	Horizontal period (High)	THd	960	960	960	clock	
	Vertical period	TV	1109	1125	(1400)	line	
			47	60	63	Hz	
	Vertical period (High)	TVd	1080	1080	1080	line	

【Note】*When vertical period is very long, flicker and others may occur.

*Please turn off the module after it shows the black screen.

*Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.

*As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.

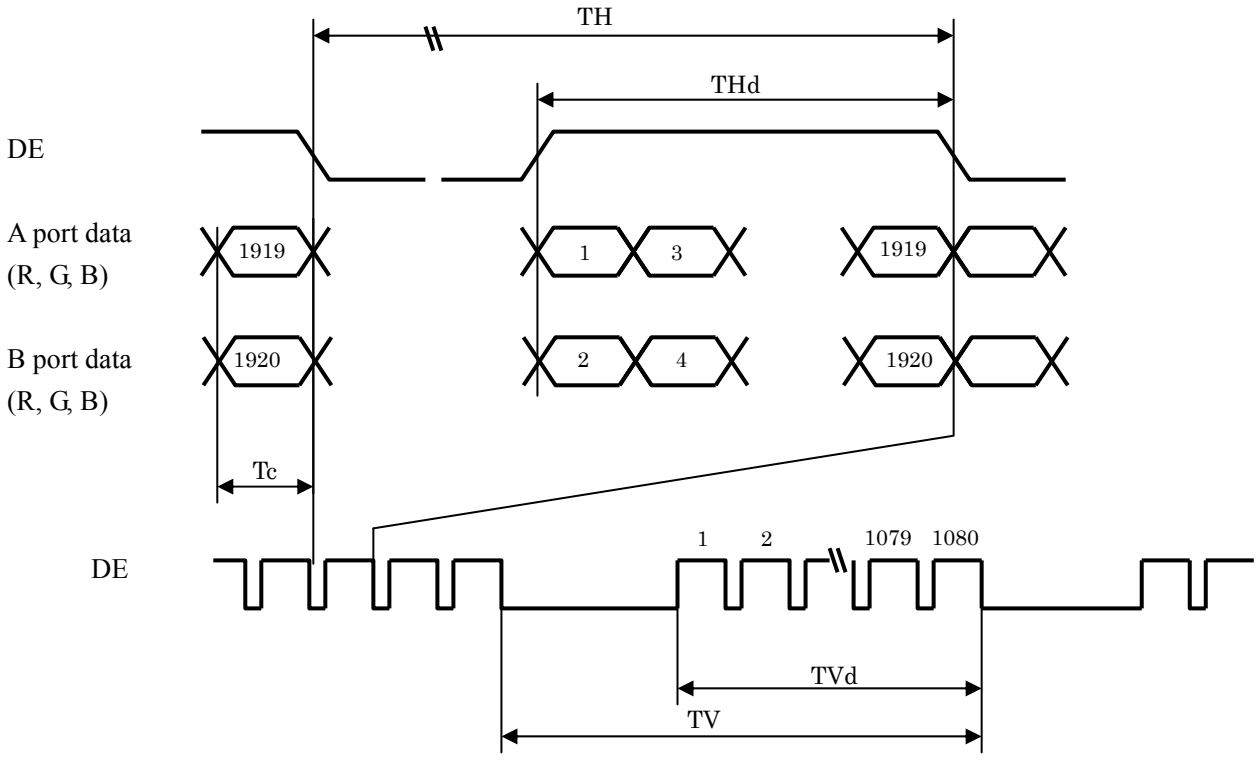
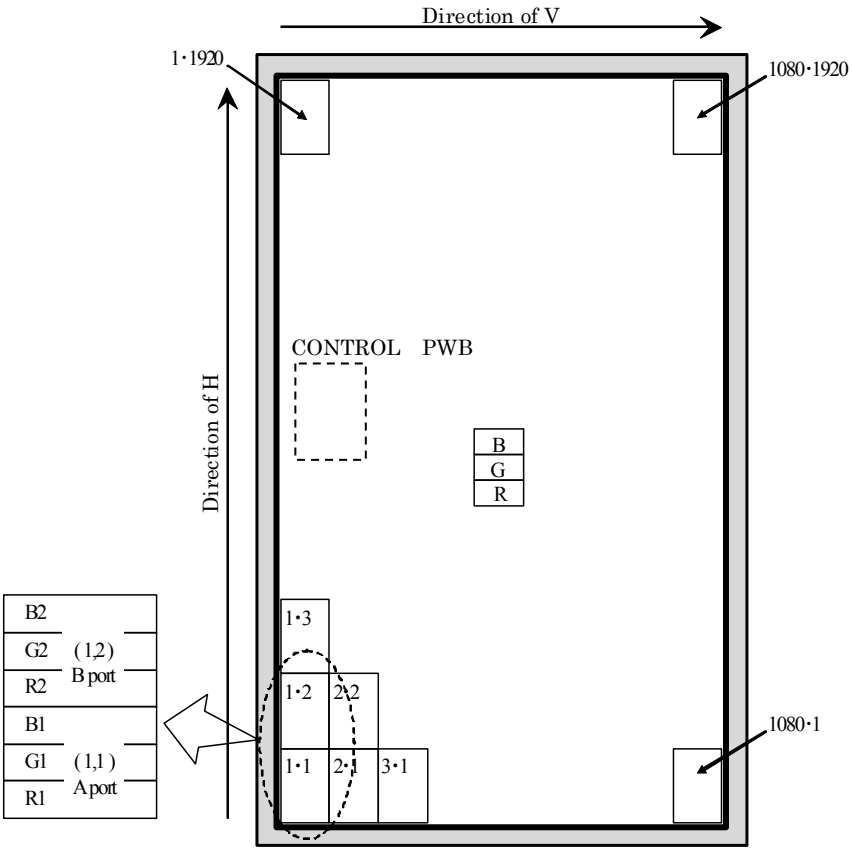


Fig.2 Timing characteristics of input signals

7-2. Input data signal and display position on the screen



Display position of data (V,H)

8. Input Signal, Basic Display Colors and Gray Scale of Each Color

	Colors & Gray scale	Gray Scale	Data signal																													
			R0	R1	R2	R3	R4	R5	R6	R7	R8	R9	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9
Basic Color	Black	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	–	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	White	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓						↓										↓										↓				
	⇩	↓						↓										↓										↓				
	Brighter	GS1021	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS1022	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS1023	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓						↓										↓										↓				
	⇩	↓						↓										↓										↓				
	Brighter	GS1021	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	⇩	GS1022	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
	Green	GS1023	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	⇧	↓						↓										↓										↓				
	⇩	↓						↓										↓										↓				
	Brighter	GS1021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1
	⇩	GS1022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
	Blue	GS1023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

0: Low level voltage, 1: High level voltage.

Each basic color can be displayed in 1021 gray scales from 10 bit data signals. According to the combination of total 30 bit data signals, the one billion-color display can be achieved on the screen.

9. Optical characteristics

Vcc = 12.0V, V_{INV} = 24.0V, Timing:60Hz, Ta=25℃(typ. Value)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21 θ 22	CR≧10	70	88	-	Deg.	[Note1][Note4]
	Vertical	θ 11 θ 12		70	88	-	Deg.	
Contrast ratio		CRn	θ =0 deg	(950)	(1500)	-		$INV_{\_duty}$=100% [Note2][Note4]
Response time		τ DRV		-	(6)	-	ms	$INV_{\_duty}$=100% [Note3][Note4] [Note5]
Chromaticity of white		x		0.257	0.287	0.317	-	$INV_{\_duty}$=100% [Note 4]
		y		0.265	0.295	0.325	-	
Chromaticity of red		x		0.564	0.594	0.624	-	
		y		0.302	0.332	0.362	-	
Chromaticity of green		x		0.259	0.289	0.319	-	
		y		0.531	0.561	0.591	-	
Chromaticity of blue		x		0.117	0.147	0.177	-	
		y		0.066	0.096	0.126	-	
Luminance of white		Y_{L1}		(800)	(1200)	-	cd/m^2	$INV_{\_duty}$=100% [Note 4]
				1200	1500	-		$INV_{\_duty}$=100% with cooling module [Note 4][Note7]
Luminance uniformity		δ w		-	-	(1.25)		[Note 6]

Measurement condition: Set the value of duty to maximum luminance of white.

*The measurement shall be executed 120 minutes after lighting at rating.

【Note】The optical characteristics are measured using the following equipment.

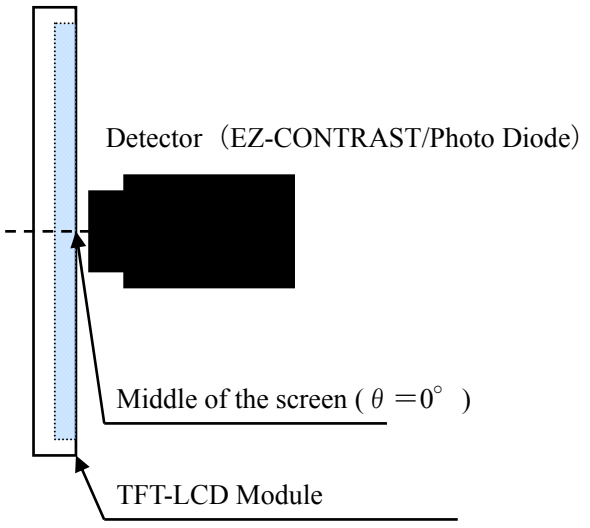


Fig.3-1 Measurement of viewing angle range and response time.

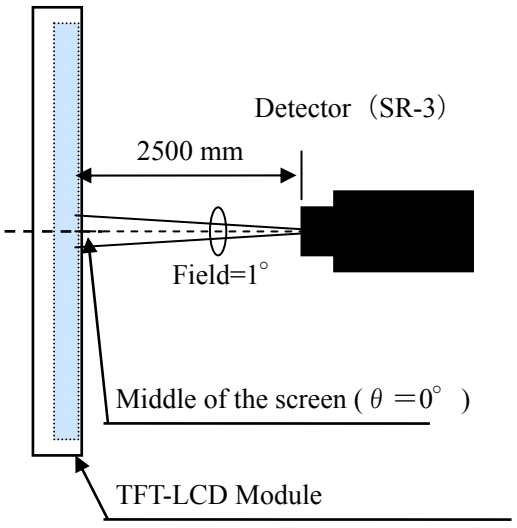
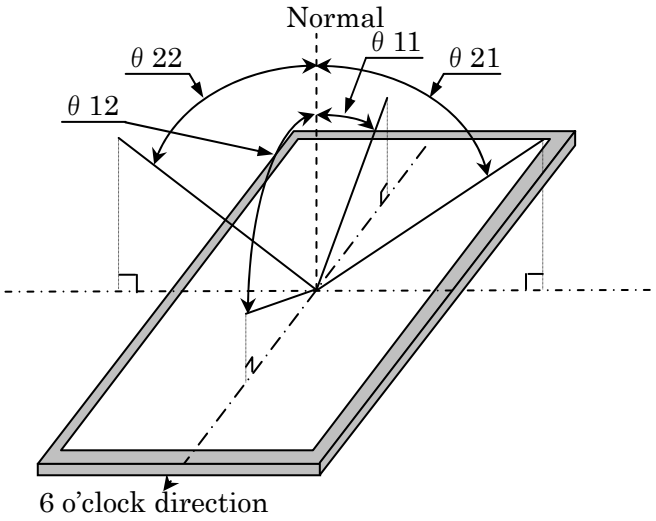


Fig.3-2 Measurement of Contrast, Luminance,Chromaticity .

Viewing angle range : EZ-CONTRAST

Response time : Photo Diode

[Note 1]Definitions of viewing angle range:



[Note 2]Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note 3]Definition of response time

The response time (τ_{Drv}) is defined as the following figure and shall be measured by switching the input signal for "five luminance ratio (0%, 25%, 50%, 75%, and 100%)" and "five luminance ratio (0%, 25%, 50%, 75%, and 100%)".

	0%	25%	50%	75%	100%
0%		tr: 0%-25%	tr: 0%-50%	tr: 0%-75%	tr: 0%-100%
25%	td: 25%-0%		tr: 25%-50%	tr: 25%-75%	tr: 25%-100%
50%	td: 50%-0%	td: 50%-25%		tr: 50%-75%	tr: 50%-100%
75%	td: 75%-0%	td: 75%-25%	td: 75%-50%		tr: 75%-100%
100%	td: 100%-0%	td: 100%-25%	td: 100%-50%	td: 100%-75%	

t*: x-y...response time from level of gray(x) to level of gray(y)

$\tau_{Drv} = \Sigma$ (t*: x-y)/20

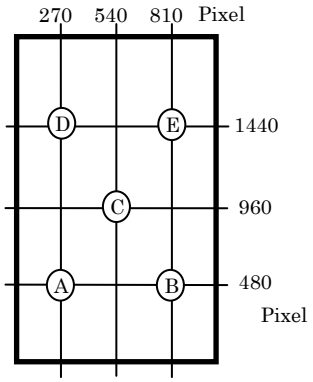
[Note 4]This shall be measured at center of the screen.

[Note 5] Response time is the value when O/S driving is used at typical input time value.

[Note 6]Definition of white uniformity;

White uniformity is defined as the following with five measurements. (A～E)

$$\delta_W = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$



[Note 7] Fig.4 shows relation between the temperature of blowing air in the thermostatic chamber and luminance of white and relation between the temperature of blowing air in the thermostatic chamber and power.

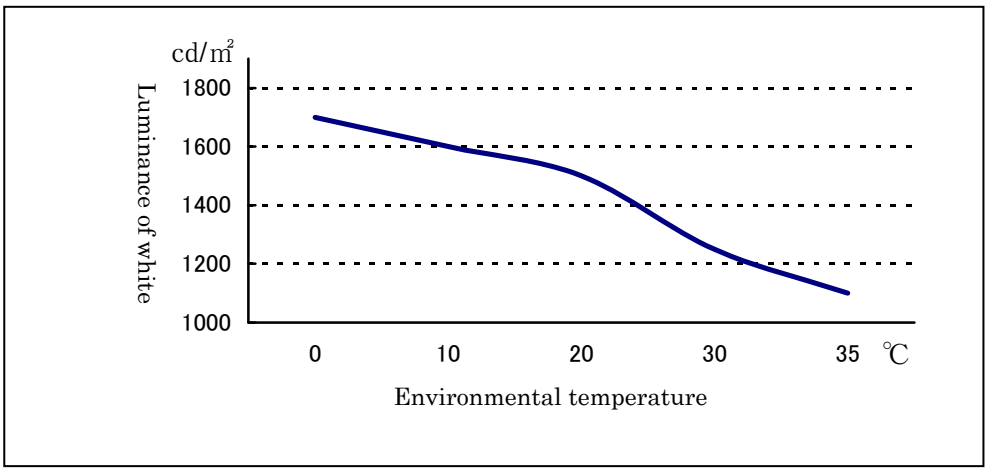


Fig.4 the temperature of blowing air in thermostatic chamber(TBD)

10. Handling Precautions of the module

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

b) This product is using the parts (inverter, CCFT etc), which generate the high voltage. Therefore, during operating, please don't touch these parts.

c) Brightness control voltage is switched for "ON" and "OFF", as shown in Fig.5. Voltage difference generated by this switching, ΔV_{INV}, may affect a sound output, etc. When the power supply is shared between the inverter and its surrounding circuit. So, separate the power supply of the inverter circuit with the one of its surrounding circuit.

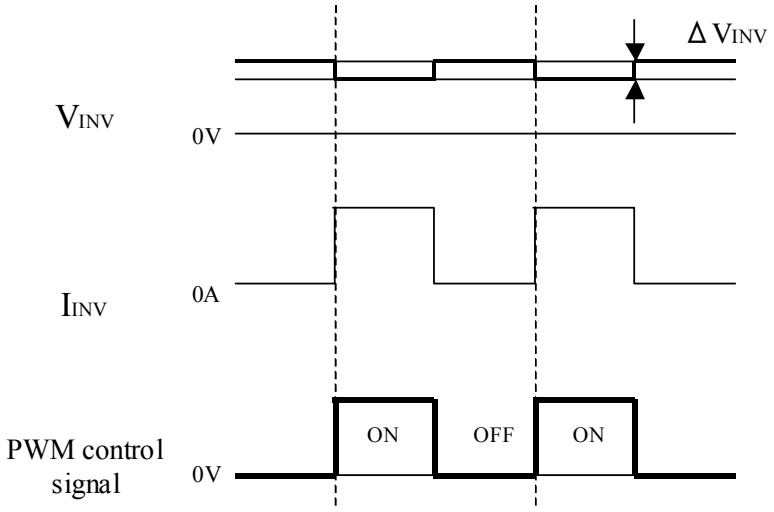


Fig.5 Brightness control voltage.

d) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

e) Since the front polarizer is easily damaged, pay attention not to scratch it.

f) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.

g) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

h) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
i) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.
j) The module has some printed circuit boards (PCBs) on the back side, take care to keep them from any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
k) Observe all other precautionary requirements in handling components.
l) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc... So, please avoid such design.
m) When giving a touch to the panel at power on supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.
n) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
o) Lamps of the backlight are placed horizontally to the short side of LCD module. The lifetime of the backlight shortens if the module is used in landscape position.
p) Make sure that the LCD module is operated within specified temperature and humidity.
Measures against dust, water, vibration, and heat radiation, etc. are required at the cabinet or equipment side.
And image retention may occur if same fixed pattern is displayed for a long time.
In some cases, it may not disappear. It is recommended to use moving picture periodically.
After long-term static display, periodical power-off or screen saver is needed. For screen saver,
moving picture or black pattern is strongly recommended.
Avoid combination of background and image with large different luminance.
Please consider the design and operating environment.
q) Ultra-violet ray filter is necessary in outdoor environment.
r) Operation for 24 hours a day is NOT recommended.
s) Well-ventilated place is recommended to set up Information Display system.
t) Execute it at 0℃ or above when you light the module. There is a possibility of don't lighting when begin lighting at a temperature that is lower than 0℃
u) If you control the temperature of the ambient air or the module, please equalize the temperature of the module.

11. Packing form

a) Piling number of cartons: 1 maximum. (Do not pile up.)

b) Packing quantity in one carton: 4 pcs.

c) Carton size: (1230) (W) × (1090) (D) × (2134) (H)

d) Total mass of one carton filled with full modules: (TBD)kg

e) Packing Form is shown in Fig 5. (TBD)

12. Reliability test item *only as for the module.

No.	Test item	Condition
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta=-20℃ 240h
3	High temperature and high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=40℃ 240h
5	Low temperature operation test	Ta= 0℃ 240h
6	Vibration test* (non-operation)	Frequency: 10~57Hz/Vibration width (one side): 0.075mm : 58~500Hz/Acceleration: 9.8 m/s^2 Sweep time: 11 minutes Test period: 1.5 hours (0.5h for each direction of X, Y, Z)
7	Shock test* (non-operation)	Maximum acceleration: 294m/s^2 Pulse width: 11ms, sinusoidal half wave Direction: (+/-Y), once for each direction.
8	ESD	At the following conditions, it is a thing without incorrect operation and destruction. (1)Non-operation: Contact electric discharge +/-10kV Non-contact electric discharge+/-20kV (2)Operation Contact electric discharge +/-8kV Non-contact electric discharge +/-15kV Conditions: 150Pf,330ohm

【Note】these items apply to the single module.

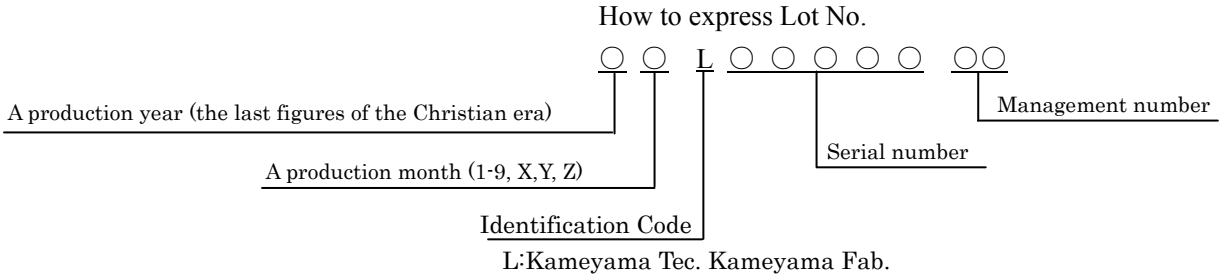
【Result evaluation criteria】

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

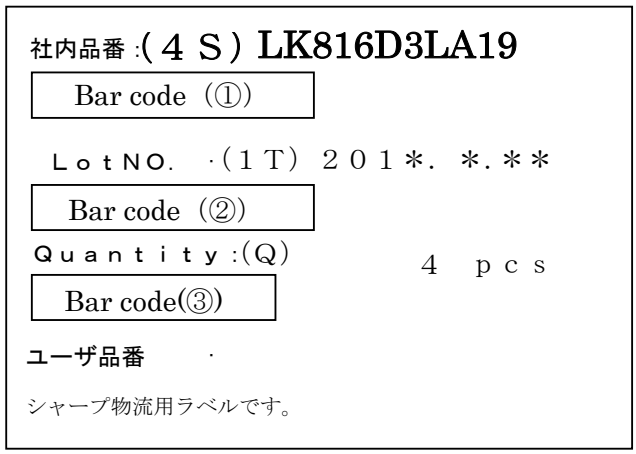
13. Others

1) Lot No. Label

The label that displays SHARP, product model (LK816D3LA19), a product number is stuck on the back of the module.



2) Packing Label



① Management No. (LK816D3LA19)

② Lot No. (Date)

③ Quantity

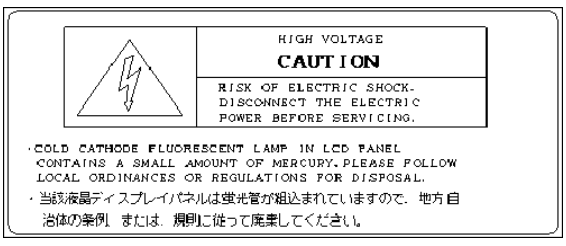
3) Adjusting volume has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

4) Disassembling the module can cause permanent damage and should be strictly avoided.

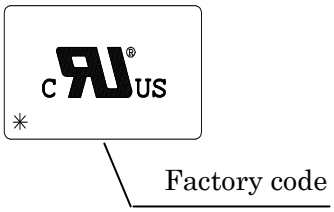
5) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

6) The chemical compound, which causes the destruction of ozone layer, is not being used.

7) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury. Please follow local ordinances or regulations for disposal. It is displaying the label in the module back.



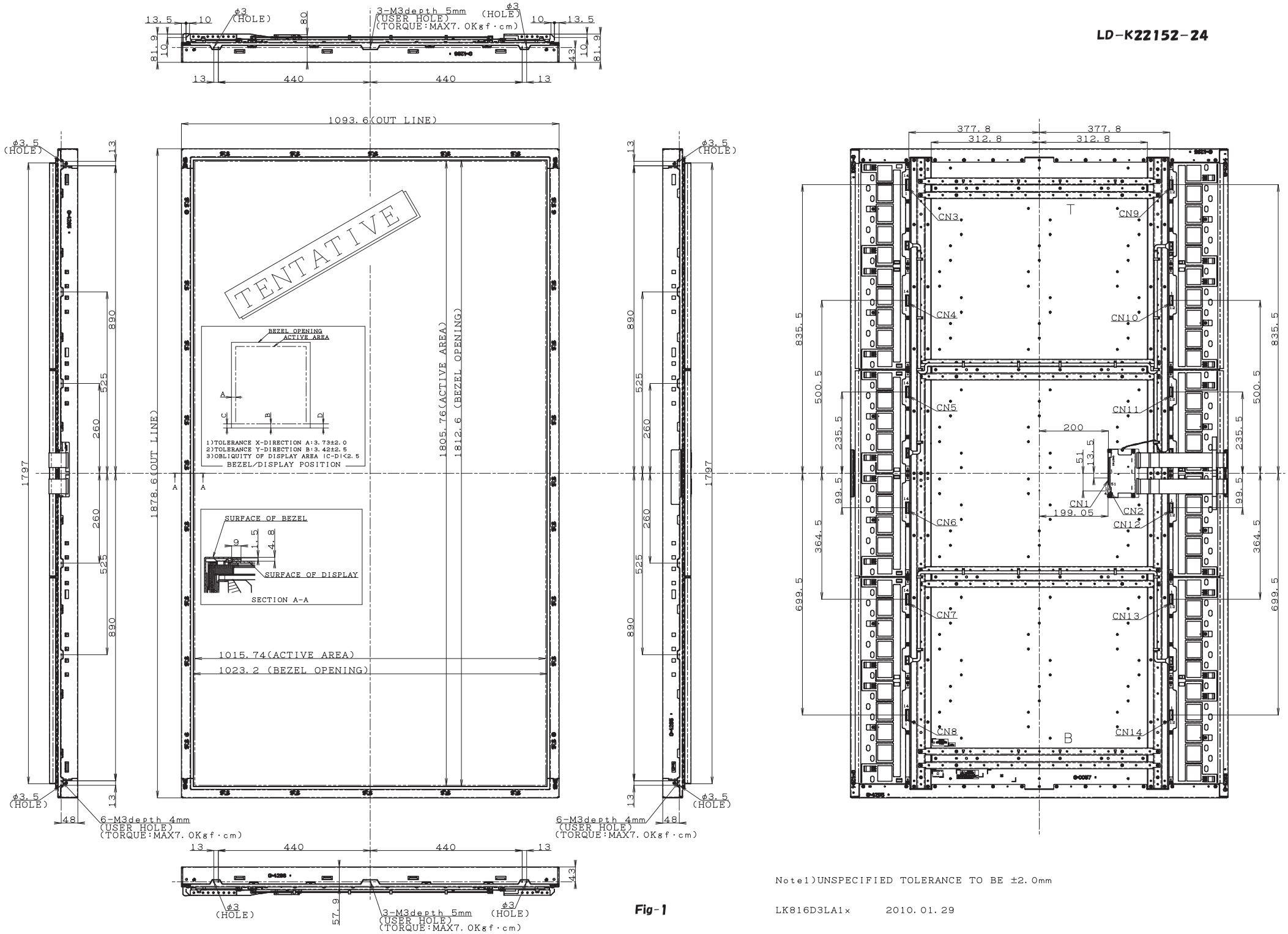
8) This LCD is appropriate to UL. Below figure shows the UL label.



9) This module is corresponded to RoHS
10) The chemical compound, which causes the destruction of ozone layer, is not being used.
11) Rust on the module is not taken up a problem.
12) Appearance quality and standard are referred to the outgoing incoming inspections.
13) Rust on the module is not taken up a problem.

14. Carton storage condition

Temperature	0℃ to 40℃
Humidity	95%RH or less
Reference condition	: 20℃ to 35℃ , 85%RH or less (summer)
	: 5℃ to 15℃ , 85%RH or less (winter)
	・the total storage time (40℃,95%RH) : 240h or less
Sunlight	Be sure to shelter a product from the direct sunlight.
Atmosphere	Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.
Notes	Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment Please keep LCD module in Portrait position. (The long side of LCD module is placed vertically)
Storage life	1 year



Note1)UNSPECIFIED TOLERANCE TO BE ±2.0mm

LK816D3LA1× 2010.01.29

Fig-1